

FEDERAL - STATE COOPERATIVE

SNOW SURVEYS AND IRRIGATION WATER FORECASTS

Montana and Northern Wyoming Upper Missouri, Upper Columbia and Yellowstone Rivers

By
Division of Irrigation, Soil Conservation Service
United States Department of Agriculture
and

Montana Agricultural Experiment Station

In cooperation with the U. S. Forest Service, U. S. Geological Survey, National Park Service, U. S. Bureau of Reclamation, State Engineers of Montana and Wyoming and other Federal, State and local organizations.

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FEDERAL-STATE COOPERATIVE SNOW SURVEYS

AND

IRRIGATION WATER FORECASTS

FOR

MONTANA and NORTHERN WYOMING

Upper Missouri and Upper Columbia River
Basins

Report Prepared by

Ashton R. Codd: Hydraulic Engineer Soil Conservation Service

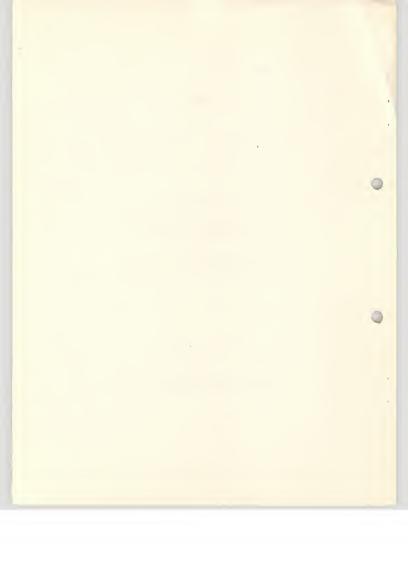
and

O. W. Monson: Irrigation Engineer Montana Agricultural Experiment Station

> Division of Irrigation Soil Conservation Service

> > and

Montana Agricultural Experiment Station Bozeman, Montana



IRRIGATION WATER SUPPLY OUTLOOK MAY 1, 1951

May 1 snow surveys on the headwaters of the Columbia and Missouri Rivers in Montana indicate an ample supply for irrigation on those streams with reservoir control. Other streams may run short during the latter part of the season.

Similar conditions prevail in Northern Wyoming in the Big Horn, Shoshone and Wind River drainage basins.

Storage reservoirs, filled to capacity are assured by the end of the snowmelt season.

Stream flow has generally been above average since October.

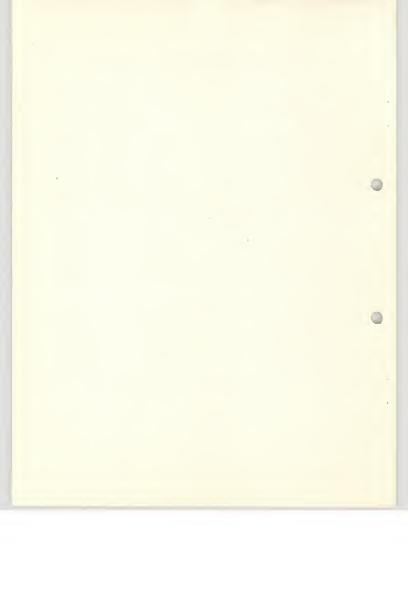
Valley precipitation has been above average west of the continental divide in Montana; but east of the divide extending into eastern Montana and Northern Wyoming, precipitation has been below average and is seriously effecting those areas depending upon precipitation for wheat and other dry farming crops.



MAY 1, 1951
PRELIMINARY ESTIMATES OF RUNOFF OF REPRESENTATIVE
STREAM GAGE STATIONS IN MONTANA AND NORTHERN WYOMING

MISSOURI BASIN FORECAST IN ACRE FEET	NAME OF STREAM AND STATION	May-June	July-Aug. Sept.	May-Sept.	Percent Average
Gallatin River at Logan 256,000 180,000 455,000 110	MISSOURI BASIN	FO	RECAST IN A	CRE FEET	
Madison River at West Yellowstone 101,000 76,000 177,000 116 Hyelite Creek at Ranger Station 20,400 11,200 31,800 102 No. Fk. Musselshell at Delphine 1,400 1,000 2,400 109 Judith River near Utica 22,570 8,600 30,580 82 Yellowstone River at Corwin Springs 1,050,000 720,000 1,770,000 107 Big Hole River at Melrose 567,200 223,400 790,600 138 Missouri River at Fort Benton 2,025,000 1,050,000 3,075,000 110 LOWER YELLOWSTONE RIVER (WYOMING) April-June April-Sept. April-Sept. No. Fk. Popo Agic River near Lander 47,500 60,960 111 Wind River at Hiverton 352,300 670,000 140 Shoshone River below Buffalo Bill 574,800 1,037,000 130 Middle Fork Powder near Kaycee 66,430 75,150 102 Tongue River near Dayton 92,250 119,580 98 Tongue River near Dayton 92,250	Gallatin River at Gateway	267,600		460,000	123
Hyalite Creek at Ranger Station 20,400 11,200 31,600 102	Gallatin River at Logan	256,000	180,000	455,000	110
No. Fk. Musselshell at Delphine 1,400 1,000 2,400 109 Judith River near Utica 22,570 8,600 30,580 82 Yellowstone River at Corwin Springs 1,050,000 720,000 1,770,000 107 Big Hole River at Melrose 567,200 223,400 790,600 138 Missouri River at Fort Benton 2,025,000 1,050,000 3,076,000 110 LOWER YELLOWSTONE RIVER (WYOMING) April-June April-Sept. April-Sept. No. Fk. Popo Agie River near Lander 47,500 60,960 111 Wind River at Riverton 352,300 670,000 140 Shoshone River below Buffalo Bill 574,800 1,037,000 130 Middle Fork Powder near Kaycee 66,430 75,150 102 Tongue River near Dayton 92,250 119,580 98 Tongue River at Acme 234,000 285,000 15 Goose Creek near Sheridan 48,210 58,470 85 UPFER COLUMBIA RIVER BASIN Bitterroot River at Darby		101,000	76,000	177,000	116
Judith River near Utica 22,570 8,600 30,580 82 Yellowstone River at Corwin Springs 1,050,000 720,000 1,770,000 107 81 Hole River at Melrose 567,200 223,400 790,600 138 Missouri River at Fort Benton 2,025,000 1,050,000 3,075,000 110	Hyalite Creek at Ranger Station	20,400	11,200	31,600	102
Yellowstone River at Corwin Springs	No. Fk. Musselshell at Delphine	1,400	1,000	2,400	109
Big Hole River at Melrose 567,200 223,400 790,600 138 Missouri River at Fort Benton 2,025,000 1,050,000 3,075,000 110 LOWER YELLOWSTONE RIVER (WYOMING) April-June April-Sept. No. Fk. Popo Agic River near Lander 47,500 60,960 111 Wind River at Hiverton 352,300 670,000 140 Shoshone River below Buffalo Bill 574,800 1,037,000 130 Middle Fork Powder near Kaycee 65,430 75,150 102 Tongue River near Dayton 92,250 119,580 98 Tongue River at Aome 234,000 285,000 115 Goose Creek near Sheridan 48,210 58,470 85 UPFER COLUMBIA RIVER BASIN Bitterroot River at Darby 422,000 520,000 125 Clark Fork above Missoula 1,600,000 1,720,000 134 Clark Fork bove Missoula 2,700,000 3,140,000 125 Clark Fork above Missoula 6,100,000 7,200,000 157 Flathead River at Columbia Falls	Judith River near Utica	22,570	8,600	30,580	82
Missouri River at Fort Benton 2,025,000 1,050,000 3,075,000 110	Yellowstone River at Corwin Springs	1,050,000	720,000	1,770,000	107
LOWER YELLOWSTONE RIVER (WYOMING) April-June April-Sept.	Big Hole River at Melrose	567,200	223,400	790,600	138
No. Fk. Popo Agie River near Lander	Missouri River at Fort Benton	2,025,000	1,050,000	3,075,000	110
Wind River at Riverton 352,300 670,000 140 Shoshone River below Buffalo Bill 574,800 1,037,000 130 Middle Fork Powder near Kayeee 66,430 75,150 102 Tongue River near Dayton 92,250 119,580 98 Tongue River near Dayton 234,000 285,000 115 Goose Creek near Sheridan 48,210 58,470 85 UPPER COLUMBIA RIVER BASIN Bitterroot River at Darby 422,000 520,000 125 Clark Fork above Missoula 1,600,000 1,720,000 134 Clark Fork te Sts. Regis 3,520,000 4,160,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Plains 8,700,000 12,300,000 147	LOWER YELLOWSTONE RIVER (WYOMING)	April-June		April-Sept.	
Shoshome River below Buffalo Bill 574,800 1,037,000 130 Middle Fork Powder near Kayeee 66,430 75,150 102 101,000 130 101,000 130 101,000 130	No. Fk. Popo Agie River near Lander	47,500		60,960	111
Middle Fork Powder near Kaycee 66,430 75,150 102 Tongue River near Dayton 92,250 119,580 98 Tongue River at Aome 234,000 285,000 115 Goose Creek near Sheridan 48,210 58,470 85 UPPER COLUMBIA RIVER BASIN Bitterroot River at Darby 422,000 520,000 125 Clark Fork above Missoula 1,600,000 1,720,000 134 Clark Fork below Missoula 2,700,000 3,140,000 125 Clark Fork at St. Regis 3,520,000 4,160,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Plains 8,700,000 12,300,000 147	Wind River at Riverton	352,300		670,000	140
Tongue River near Dayton 92,250 119,580 98	Shoshone River below Buffalo Bill	574,800		1,037,000	130
Tongue River at Acme 234,000 285,000 115 Goose Creek near Sheridan 48,210 58,470 85 UPPER COLUMBIA RIVER BASIN Bitterroot River at Darby 422,000 520,000 125 Clark Fork above Missoula 1,600,000 1,720,000 134 Clark Fork below Missoula 2,700,000 3,140,000 132 Clark Fork at Sts. Regis 3,520,000 4,150,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Plains 8,700,000 12,300,000 147	Middle Fork Powder near Kaycee	66,430		75,150	102
Goose Creek near Sheridan 48,210 58,470 85	Tongue River near Dayton	92,250		119,580	98
UPPER COLUMBIA RIVER BASIN Bitterroot River at Darby 422,000 520,000 125 Clark Fork above Missoula 1,600,000 1,720,000 134 Clark Fork below Missoula 2,700,000 3,140,000 132 Clark Fork at St. Regis 3,520,000 4,150,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Plains 8,700,000 12,300,000 147	Tongue River at Acme	234.000		285,000	115
Bitterroot River at Darby 422,000 520,000 125	Goose Creek near Sheridan	48,210		58,470	85
Clark Fork above Missoula 1,600,000 1,720,000 134 Clark Fork below Missoula 2,700,000 3,140,000 132 Clark Fork at St. Regis 3,520,000 4,160,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Plains 8,700,000 12,300,000 147	UPPER COLUMBIA RIVER BASIN				
Clark Fork below Missoula 2,700,000 3,140,000 132 Clark Fork at St. Regis 3,520,000 4,150,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Plains 8,700,000 12,300,000 147	Bitterroot River at Darby	422,000		520,000	125
Clark Fork at St. Regis 3,520,000 4,150,000 125 Flathead River at Columbia Falls 6,100,000 7,200,000 157 Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Flains 8,700,000 12,300,000 147	Clark Fork above Missoula	1,600,000		1,720,000	134
Flathead River at Columbia Fall: 6,100,000 7,200,000 157 Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Plains 8,700,000 12,300,000 147	Clark Fork below Missoula	2,700,000		3,140,000	132
Flathead River at Polson 6,200,000 7,800,000 153 Clark Fork River at Plains 8,700,000 12,300,000 147					125
Clark Fork River at Plains 8,700,000 12,300,000 147					
-,,					
Clark Fork River at Heron 11,000,000 14,100,000 139		8,700,000		12,300,000	147
	Clark Fork River at Heron	11,000,000		14,100,000	139

Note: Probable Error for these forecast is plus or minus 10 to 15% of the forecast value. Values of (r) range from 0.720 to 0.983.



The Beaverhead River above Dillon will flow a little below average this season. Below Dillon, to Sappington, it is anticipated that the flow will be above average and probably greater than last season.

The Madison River into Hebegen Reservoir should flow approximately 177,000 acre feet from May through September, or 16 percent above average. This flow should be ample to bring the reservoir to capacity by the end of the Snow Melt Season.

The Gallatin River at Gateway will flow about 460,000 acre feet during the May-September season with about two-thirds of this volume coming by the end of June, which will leave the usual August-September shortage due to the lack of storage facilities for peak flows.

The Missouri River Main Stem from Three Forks to Fort Benton should flow slightly above average. The average flow, May through September, being 2,796,000 acre feet. The forecast is for 3,075,000 acre feet.

The Sun, Teton, and Marias Rivers should flow very close to normal for the irrigation season.

The Upper Yellowstone River at Corwin Springs, below Gardiner, will flow about 7% above average during the May-September season, or close to 1,770,000 acre feet; the average for this period being 1,665,000 acre feet.

Snow measurements on the Wind River above Riverton, Wyoming, indicate an abundant water supply from that basin this season. The forecast for this river at Riverton is 670,000 acre feet for the period April-September, or 140 percent above. Heavy rains would augment this flow considerably. Warm temperature, followed by excessive rain, could cause considerable damage from extremely high flows.

The snow cover on the Pop Agie River Basin is not as high in proportion to the average as the Wind River. This river should flow about ten percent above average. A good supply of water is anticipated for this season.

On the Shoshome River, below Buffalo Bill Reservoir, the flow for April-September will be approximately 1,037,000, or 140 percent of average for that period. This volume should assure ample water for irrigation and power demands during the season.



The Tongue and Powder Rivers in Wyoming will flow approximately normal during the season and should produce more water than last season. Snow surveys last season were low, about 60% of normal. This year, the water content in the snow indicates about 100 to 115% of average which should produce a good water supply this season.

UPPER COLUMBIA RIVER WATER SUPPLY OUTLOOK

May 1 snow survey on the upper Kootenai indicates a water supply of 10 to 30 percent above average. The snow pack is not as heavy as last season, which averages close to 150% of normal.

May 1 water content measurements made on the Flathead River Basin have increased slightly during the month of April. It is anticipated that the water supply during April-September at Columbia Falls, will be approximately 7,200,000 acre feet, with about 6,100,000 passing Columbia Falls during April and Junes.

May 1 measurements in the entire Columbia River Basin were hampered by a large storm which occurred on April 29-30, which added materially to the snow pack in the high elevations but would disappear very rapidly in the lower regions of the river basin.

The Upper Clark Fork River Basin was effected by this April 29-30 storm and has increased the percentage figures in low elevations out of proportion. It is believed that the April water content measurements will be more in line with perspective flows than are the May measurements. For the reason stated above, the forecast issued on April 1 are still being used as the May 1 forecast.

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SUPPLEMENTAL INDEX LIST OF SNOW SURVEY COURSES IN ADJACENT BASINS, USED IN THIS REPORT AND SHOWN ON THE INDEX MAP

	DRAINAGE AND SNOW COURSE	Adj. State No.	Montana Number	Elev. Feet	Section Lat.	Twp	Range Long.	Record Began	Measurement Dates	Meas- ured By
	JEFFERSON	Idaho								
	Kilgore	10	11512	6200	6	12N	39E	1937	1,2,3,4,5	pd.obs.
	Blue Ridge Mine	5	11511	6700	27	13N	38E	1938	4	pd.obs.
	Camp Creek	6	12E3	6800	21	13N	3 61S	1936	1,2,3,4	1
	Moose Creek	8	13016	6200	22-27	27N	21E	1937	3,4,5	1
	Big Springs	3	11E9	6500	34	19N	44E	1936	1,2,3,4,5	10
	Island Park	9	11210	3600	28	13N	43E	1936	1,2,3,4,5	10
	Valley View	17	11E8	6500	7	15N	44E	1936	1,2,3,4	10
0	UPPER YELLOWSTO	NE Wyo.								
	Lewis Lake Div.	9	10E9	7900	44-13	11	0-40	1919	1,2,3,4	10
	Aster Creek	2	10E8	7700	44-17	11	10-37	1919	1,2,3,4	10
	Tom Thumb Summi	t	1027	7900	44-22	11	LO-35	1949	3,4	10
	LOWER YELLOWSTO	NE Wyo.								
	Togwotee Pass	12	10F1	9600	29	44N	110W	1936	2,3,4,5	10
	Kendall	25	9F12	7900	23	38N	110W	1936	3.4.5	1
	Loomis Park	26	10F4	8500	14	37N	111W	1942	3,4,5	î
	Yellow Jacket	14	10F5	6775	33	42N	112W	1936	3,4,5	î
	Black Rock	2	10F3	8600	4	44N	111W	1936	2, 4	10
	Dutch Joe	23	9 G6	8700	32	31N	104W	1936	4.5	1
	Mulligan Park	24	9 G 5	8900	17	35N	108W	1936	3,4,5	1
	KOOTENAI	Idaho								
	Smith Creek	13	16A1	4800	29	64N	3W	1937	4,5	1
6		Canada								
-	Fernie	10		3500	49-31	13	15-01	1939		
	New Fernie	10A		4100						
	Gray Creek	34		5100	39-37	13	L6-41	1948		
	Marble Canyon	32		5000	51-12	13	16-09	1947		
	Nelsen Creek	19		3050	44-25	13	17-14	1938		
	Sinclair Pass	A.S		4500	50-40	13	15-58	1947		
	Sullivan Mine	20A		5100	49-43	1:	16-01	1945		
	Upper Elk River			4400	50-01		L4-56	1947		
	Kimberly	20		3800	49-41	1:	15-59	1945		
	UPPER CLARK FOR									
	49 Meadows	1	15B10	5000	6	43N	5E	1937	1,2,3,4,5	1
	Lookout	10	15B2	5250	4	47N	6E	1921	1,2,3,4,5	1
	Above Roland	2	15B7	4350	35	47N	6E	1926	3	12*
	Below Roland	3	15B6	3770	34	47N	6E	1926	3	12
	Sunset	16	15B 9	5600	28	49N	5E	1921	3	12
	PEND OREILLE	Idaho								
	Mosquite Ridge	9	1644	5110	5	54N	2E	1937	4,5	1
	Freezeout #2		15B10	6800	21	15N	2717	1951	3,4	1

SUPPLEMENTAL INDEX LIST OF SNOW SURVEY COURSES IN ADJACENT BASINS, USED IN THIS REPORT AND SHOWN ON THE INDEX MAP

DRAINAGE AND SNOW COURSE	Adj. State No.	Montana Number	Elev. Feet	Section Lat.	Twp	Range Long.	Record Began	Measurement Dates	Meas- ured By
BITTERROOT	Idaho								
Moose Creek	8	13D16	6200	22-27	27N	21N	1937	3,4,5	1
Kit Carson	3	14D3	4700	4	27N	16E	1937	4	1
Savage Pass	7	14C4	6000	18	36N	15E	1937	4	1
Powell Pasture	6	15C3	3700	27	27N	14E	1937	4	1
Packers Mdw.	5	1402	5700	15	38N	15E	1937	2,3,4,5	1
FLATHEAD									
Basin Creek		13-B-14	5000	11	19N	12W	1951	2.3.4.5	1
Holbrook		13-B-13	4530	18	21N	13W	1951	2,3,4,5	1
Trout Lake #2		13-A-12	3600	21	281	17W	1951	2,3,4,5	1 0
Twin Creeks		13-B-11	3580	14	26N	16W	1951	2,3,4,5	1
Quintonkon		13-4-13	3800	11	26N	17W	1951	2,3,4,5	1
TONGUE RIVER									
Burgess Ranger	Sta.	7-E-4	7900	36	56N	89W	1950	3,4,5	Pd.Obs.
Dome Lake		7-2-5	8800	11	53N	87W	1950	3,4,5	Pd.Obs.
POWDER RIVER									
Soldier Park		7-E-6	8700	36	51N	85W	1950	3,4,5	Pd.Obs.i
Muddy Pass		7-R-7	9700	11	48N	85W	1950	3,4,5	Pd.Cbs.
North Powder		7-E-8	8500	- 5	4711	85W	1951	3.4.5	Pd. Obs

^{*}Washington Water Power Company

STORAGE IN RESERVOIRS OF MONTANA AND NORTHERN WYOMING Reservoir Volumes in 1,000's of Acre Feet

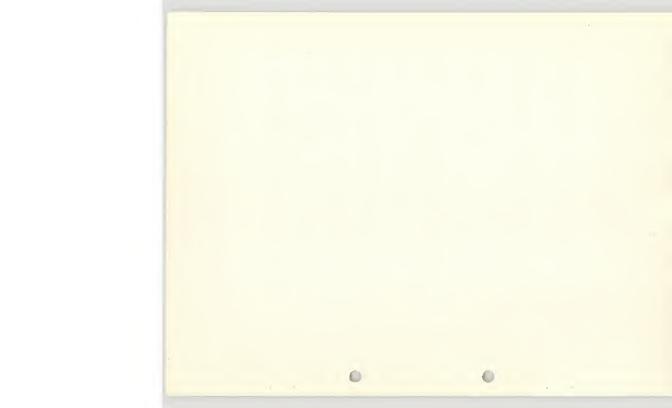
	Reservoir	Location on or Diversion from	Usable Capacity	Contents This Year May 1 1951	Contents Last Year May 1 1950	May 1 10-Year Average 1940-49
	Lake Sewall	Missouri	37.8	20.5	12.2	
	Hauser Lake	Missouri	52.1	45.7	34.0	43.9
	Holter Reservoir	Missouri	81.9	56.5	68.0	53.1
	Fort Peck Res.	Missouri	19,000.0			10,202.0
	Ruby Reservoir	Ruby	38.5	1),400.0	10,0000	
	Hebgen Reservoir	Madison River	345.0	261.3	231.4	234.4
	Madison Reservoir	Madison River	41.0	29.9	32.8	33.6
	Smith River Res.	Smith River	10.7	27.7	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,,,,,
	Gibson Reservoir	N.Fk. Sun River	105.0	81.7	52.5	71.5
	Willow Creek	N.Fk.Sun-Willow Cr.	32.3	27.1	5.9	13.9
	Pishkun Reservoir	N.Fk. Sun River	32.0	19.0	24.7	20.3
,	Lower Two Medicine L.	Two Medicine River	14.0	0	0	2007
	Four Horns Res.	Badger Creek	20.0	8.6	6.3	8.6
	Birch Creek Res.	Birch Creek	30.0	30.2	24.9	25.2
	Lake Francis Res.	Birch Creek	112.0	102.2	91.4	81.7
	Askley Lake	Judith River	5.8	102.02	4.4	4.3
	Durand Reservoir	N.Fk. Musselshell	7.0		7.0	407
	Dead Man Basin	Musselshell River	52.5		100	4
	Martinsdale Res.	S.Fk. Musselshell	23.1		14.6	10.6
	Fresno Reservoir	Milk River	127.2	132.5	60.9	70.5
	Nelson Reservoir		66.8	18.5	13.4	33.3
		Milk Reservoir		1.3	0.6	3.4
	Mystic Lake	W. Rosebud Creek	20.8 27.5	16.5	19.0	14.5
	Cooney Reservoir	Red Lodge Creek		10.5	15.6	16.5
	Tongue Reservoir Sherburne Lake Res.	Tongue River	73.9 66.1		34.2	1009
		Swiftcurrent Creek				
	Lake Helena	Missouri River	10.4	7.2	2.7	
,	YELLOWSTONE RIVER B	ASIN (Wyoming)				
	Buffalo Bill	Shoshone	456.6	236.2	164.3	265.3
	Pilot Butte	Wind River	30.1	2,0002	19.9	21.2
	Bull Lake	Wind River	155.0		6.8	52.6
	COLUMBIA RIVER BASI	N (Montana)				
	Georgetown Lake	Flint Creek	31.0	21.4	19.0	24.1
	E.Fk.Rock Cr. Res.	E. Fk. Rock Creek	16.0	-1011	2,0-	
	W. Fk. Bitterroot Res.	W. Fk. Bitterroot	31.7	20.5	3.5	13.3
	Como Lake	Rock Creek	34.8	1	1	
	Flathead Lake (Sommers)		1,791.0	990.6	826.9	663.1
	*Little Bitterroot	Little Bitterroot	37.1	36.1	32.6	11.8
	*Dry Fork Reservoirs	Dry Fork Creek	6.7	5.8	6.0	3.9
	**Mission Valley	Mission Valley	0.7).0		1
	9 Reservoirs	(Flathead River)	105.0	58.8	35.4	48.9
	0 1/0201 40119	(Toolload III Aol.)	10000	2000	1	1

^{*}Comprised of two reservoirs on Little Bitterroot River
*Comprised of two reservoirs on Dry Fork Creek.
**Comprises nine small reservoirs on Mission Valley Indian Irrigation Service Project.



PRECIPITATION DATA FOR MAY 1, 1951 MONTANA

					Γ		4-				- 4	
			1950			199			Apr.		al Accumu	lation
Station	Elev-		cipitat			recipit			Dept. from	Precipita		-
	ation	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Normal	1950-51	Normal	Depart.
WEST OF DIVIDE Butte (Airport) Phillipsburg Hamilton Fortine West Glacier Summit (Marias) Ovando 1 SW Trout Creek Thompson Falls Average (9)	5533 5280 3529 3000 3154 5213 4101 2485 2435	0.53 0.51 1.78 3.46 5.87 7.53 1.02 6.36 h.36	1.20 1.25 1.58 1.50 2.35 6.13 2.38 3.95 2.79 2.56	0.59 0.64 0.71 1.99 5.17 5.88 1.63 4.67 2.25 2.61	0.92 1.43 1.21 0.97 4.77 5.37 1.53 5.42 2.97 2.73	0.82 1.45 1.52 0.89 4.88 6.52 1.72 6.51 3.44	1.01 1.85 1.39 1.12 1.89 3.66 1.12 1.96 1.03	0.87 1.21 0.36 2.04 1.67 2.97 1.13 0.98 1.53	- 0.16 + 0.02 - 0.51 + 0.50 + 0.17 + 0.69 + 0.18 - 0.10 + 0.09 + 0.09	5.94 8.40 8.55 11.97 26.60 38.06 10.53 29.85 18.37	4.19 6.28 5.53 8.99 16.61 19.82 9.66 21.45 13.01	+ 1.75 + 2.12 + 3.02 + 2.98 + 9.99 + 18.21 + 0.87 + 8.40 + 5.36 + 5.86
CENTRAL DIVISION Babb Havre Great Falls (Airport) Helena (Airport) Lewistown (Airport) Livingston West Yellowstone Mystic Lake Average (9)	4300 2488 3664 3893 4132 4485 6058 6669 6558	1.04 0.24 0.03 0.43 0.74 0.94 1.06 2.88 0.86 0.91	1.23 0.41 1.19 1.50 0.83 1.05 1.15 1.79 2.37 1.28	0.85 0.32 0.58 0.61 1.05 0.81 0.48 1.95 1.08	0.65 0.39 0.41 0.38 0.17 0.38 0.71 2.28 2.02 0.82	1.79 0.42 1.34 0.24 0.20 0.40 0.93 1.91 0.17	2.03 0.54 1.22 0.84 0.61 1.45 0.53 2.18 3.50 1.44	2.58 0.73 2.50 1.58 0.83 1.45 0.15 0.92 1.56 1.37	+ 0.92 - 0.26 + 1.35 + 0.46 - 0.44 + 0.13 - 0.95 - 0.92 - 1.18 - 0.09	10.17 3.04 7.27 5.57 4.43 6.48 5.01 13.91 11.56 7.49	7.6h 4.62 5.38 4.39 4.57 5.83 5.67 14.56 11.47 7.12	+2.53 -1.58 +1.89 +1.18 -0.14 +0.65 -0.66 -0.65 +0.09 +0.37
EASTERN DIVISION Malta Fort Peck Medicine Lake Circle Billings Miles City Glendive Broadus Average (8)	2255 2180 1962 2428 3139 2392 2076 3026	0.39 0.24 0.50 0.54 0.83 0.40 0.45 0.46	0.18 0.25 0.10 0.18 0.88 0.52 E0.16 0.11	0.35 0.23 0.21 0.13 0.68 0.31 0.07 0.40 0.30	0.49 0.48 0.36 0.33 0.70 0.08 0.37 0.48 0.41	0.52 0.39 0.49 0.50 0.38 0.27 0.42 0.31 0.41	0.53 0.39 0.25 0.05 0.69 0.14 0.12 0.60 0.35	0.53 1.08 1.41 0.74 0.64 0.55 0.19 0.36 0.69	- 0.27 - 0.61 + 0.52 - 0.40 - 0.66 - 0.57 - 0.93 - 1.17 - 1.00	2.99 3.06 3.32 2.47 4.78 2.27 1.78 3.02 2.96	3.78 3.73 3.29 5.59 5.74 5.23 4.71 5.29 4.67	-0.79 -0.67 +0.03 -3.12 -0.96 -2.96 -2.93 -2.27 -1.71

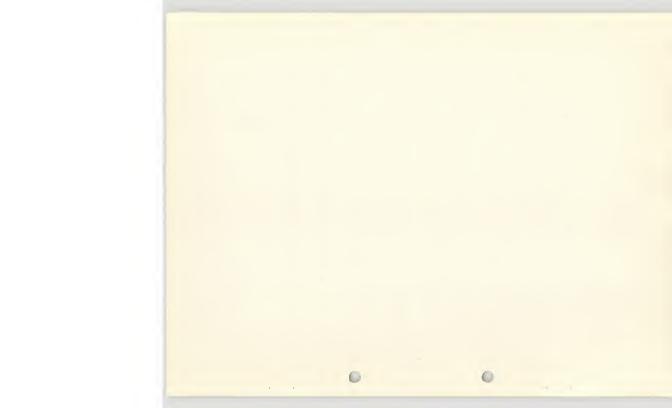


PRECIPITATION DATA FOR MAY 1, 1951 NORTHERN WYOMING

Station	Elev-		1950 cipitati			195 Precipi	tation		Apr. Dept. from	Precipi		
	ation	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Normal	1950-51	Normal	Departure
BIG HORN RIVER BASIN Cody Lovel Worland Sunshine L SW Thermopolis Riverton Dubois Average (7)	4984 3825 4061 6930 4336 4954 6917	.08 .02 T .17 .19 .22 .37	1.29 .32 .10 ·1.04 .80 .57 .71	.28 .03 .40 .29 .21 .00 T	.77 .09 T .37 .07 .05 .16	0.09 T 0.10 0.67 0.18 0.31 0.45 0.25	0.58 0.10 0.30 0.29 0.09 0.45 0.80	1.02 0.91 0.65 1.03 1.18 0.97 0.65 0.92	- 0.03 + 0.29 - 0.36 - 1.67 - 0.93 - 0.41 - 0.44 - 0.51	4.02 1.47 1.61 4.57 2.61 2.31 2.82 2.77	3.67 2.81 3.35 7.86 5.97 4.13 4.07	+ 0.35 - 0.71 - 1.74 - 3.29 - 3.36 - 1.82 - 1.25 - 1.78
TONGUE RIVER BASIN Sheridan	4021	.51	1.05	•58	•55	0.24	1.20	1.41	- 0.51	5.54	6.97	- 1.43
POWDER RIVER BASIN Arvada Metz Ranch Gillette Nine Mile Creek Mid West Average (5)	3680 5280 4542 5000 4850	.22 .37 .63 .70 .83	.31 .67 .72 .40 .47	.06 .19 .05 .05 .28	.16 .46 .50 .20 .23	0.18 0.38 0.25 0.50 0.27 0.32	0.81 0.43 1.30 0.30 0.45 0.66	0.27 0.93 0.51 0.80 0.63	- 1.02 - 0.66 - 1.22 - 1.01 - 0.97	2.01 3.43 3.96 3.33 3.18	4.90 5.05 6.15 4.83 6.23 5.45	- 2.89 - 1.62 - 2.20 - 2.95 - 2.27

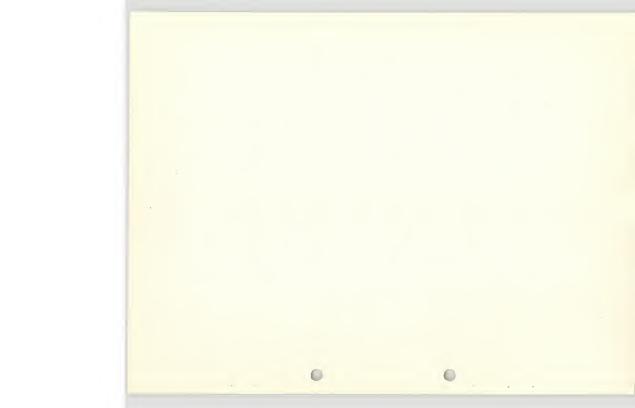


MISSOURI BASIN			Date	Snow		Water C	ontent	(Inches)		
DRAINAGE BASIN AND	No.	Elev.	of Survey	Depth (In.)	May 1	Past R	lecords	Avera	ge Data	Years of	Ground Surface
SNOW COURSE **			1951	1951	1951	1950	1949	Avg.	%Avg.	Record	Condition
JEFFERSON RIVER (Rock-Beaverhead) Lakeview Ridge	2250	7) 00			1 -						
Lakeview Canyon (Big Hole)	11E3 11E4	7400 6930	Apr. 27 Apr. 27	15.8 25.2	4.9 8.2		2.4			2 2	en
Miner Lake	13D7	6720	Apr. 30	12.2	3.4					2	Frozen
MADISON RIVER Hebgen West Yellowstone 21-Mile Norris Basin	11E5 11E7 11E6 10E2	6550 6700 7150 7500	May 1 May 1 May 2	Trace 15.3 31.0	Trace 5.1 12.5	8.4 10.0 18.8	1.2 4.4 12.6	2.7 3.4 10.2	150 123	18 18 18	Surface Not
GALLATIN RIVER Devil's Slide Hood Meadow New World 21-Mile	10D4 10D3 10D1 11E6	8100 6600 6700 7150	Apr. 29 Apr. 28 Apr. 27 May 2	50.1 17.4 20.2 31.0	18.7 5.5 7.2 12.5	24.5 8.5 10.6 18.8	20.3 1.7 — 12.6	21.3 4.2 10.2	88 131 123	17 17 2 18	Ground S
MISSOURI RIVER MAIN ST Chessman Reservoir Kings Hill Pipestone Pass Stemple Pass Tenmile, Lower Tenmile, Middle Tenmile, Upper	1205 1001 12D1 12C1 12C2 12C2 12C3 12C4	62 00 7950 72 00 69 00 62 50 68 00 80 00	May 2 May 1 May 2 May 3 May 3 May 4 May 4	14.9 52.8 29.0 44.4 20.5 39.2 46.0	3.0 12.8 6.3 11.2 5.1 11.2 14.8	7.8 19.6 3.2 14.2 8.9 16.3 18.8	0.0 12.8 1.0 6.3 0.2 3.5 7.1	1.6 11.6 1.8 5.6 2.2 6.4 10.2	187 - 111 350 200 232 175 145	16 11 12 17 16 17 16	

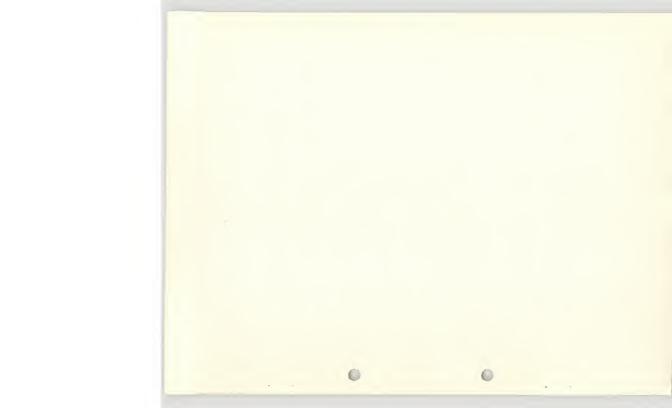


MONTANA SNOW SURVEYS, MAY 1, 1951

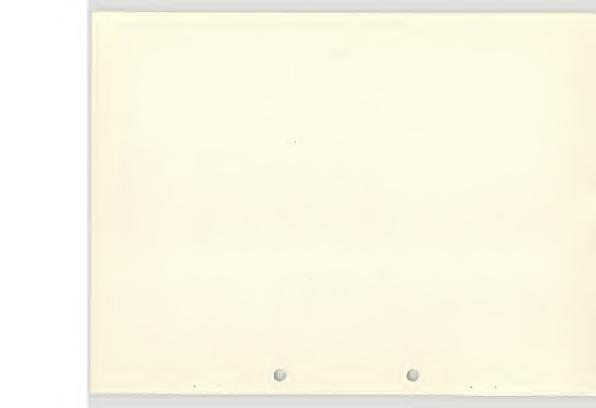
MISSOURI BASIN											
DRAINAGE BASIN			Date	Snow Depth	1	Water C	ontent		e Data	Years	Ground
AND SNOW COURSE **	No.	Elev.	Survey 1951	(In.) 1951	May 1 1951	Past R	ecords	May Avg.		of Record	Surface Condition
MISSOURI RIVER MAIN STEM (Marias River) Marias Pass Snow Lab. #16 UPPER YELLOWSTONE Canyon Cooke City	12B5 13A9 10E3 10D7	5250 5200 5200 7750 7400 7850	Apr. 27 Apr. 24 May 1	45.6 57.0	19.7 22.0	26.3 28.0	12.1 17.0	9.2 20.4 4.9 7.8	214 108	17 5	Not Frozen
Lake Camp Lodgepole, Wyo. Lupine LOWER YELLOWSTONE (Wind River)	10E4 9E1 10E1	8200 7300	Apr. 29	41.4	14.8		9.9	8.3	180	14	Ground Surface
Brooks Lake #3 Burroughs Creek Dinwoodie Dry Creek Du Nodr Geyser Creek Hobbs Park Little Warm Mosquito Park Sheridan St. Lawrence T-Cross Ranch Trout Creek *Togwotee Pass *Black Rock *Yellow Jacket * Adjacent Basin	10F2 9F6 9F10 9F9 9F2 9F3 9G2 9F1 9F11 9F11 9F5 9G1 9F5	9200 8800 10000 9500 8750 8500 10000 9500 9500 9000 8000 8400 9600 6775	Apr. 30 Apr. 30 May 3 May 2 May 1 May 6 May 1 May 6 Apr. 30 Apr. 28 May 6 May 1 Apr. 28 May 1 May 1 Apr. 30	80.0 59.0 56.0 36.0 33.0 30.0 65.3 73.0 25.2 16.0 21.6 19.0 No Sno 92.0 No Sno	40.4	33.4 17.5 10.6 11.2 7.8 30.3 22.1 14.2 3.4 9.5 5.5 11.1 29.5 27.6	22.4 11.2 11.1 3.9 1.6 0.0 21.3 13.8 7.8 0.0 5.2 0.0 33.2	22.7 14.7 15.7 8.7 6.9 6.0 25.8 20.6 8.4 1.8 8.0 3.0 3.0	133 172 118 132 165 172 100 126 106 106 225 90 234	16 3 3 11 3 3 7 12 8 10 3 3 2	GFO



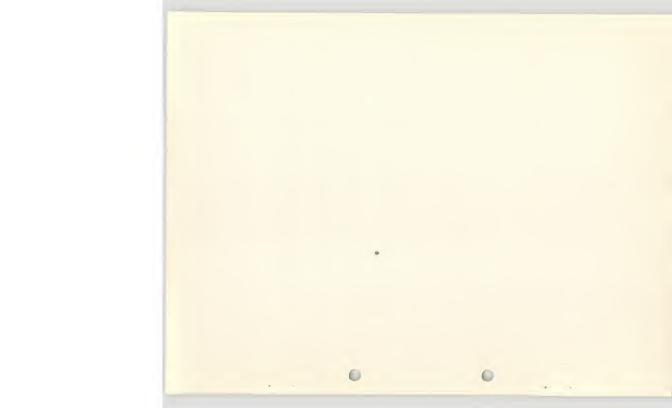
MISSOURI BASIN								7.0			
DRAINAGE BASIN AND SNOW COURSE **	No.	727	Date of Survey	Snow Depth (In.)	May 1	Past F	Content	Avera	ge Data y 1	Years of Record	Ground Surfac
SNOW COURSE **	NO.	Elev.	1951	1951	1951	1950	1949	Avg.	%Avg.	necora	Condi
POPO AGIE RIVER Blue Ridge Grannier Meadows Larsen Creek Sawmill Glade South Pass	8G2 8G4 9G4 8G1 8G3	9500 9000 9000 8500 9000	Apr. 26 Apr. 26 Apr. 27 Apr. 26 Apr. 26	41.5 40.5 Not mea 13.2 45.0	13.5 12.5 sured 5.0 14.9	19.8 23.3 4.1 23.8	11.5 13.0 1.0 13.0	12.2 13.8 5.8 13.4	111 91 86 111	12 15 12 12	
		9000	Apr. 20	45.0	14.9	23.0	15.0	13.4	111	12	
BIG HORN RIVER (Wyom Beavers Mill Owl Creek Tensleep R. S. Timber Creek Ranger Creek Wood River	ing) 9F8 8F1 7E3 9E2 7E1 9E7	8000 8700 8300 9000 8800 8000	Apr. 30 Apr. 27 May 1 Apr. 29	19.5 23.9 27.0 18.0	5.5 5.8 6.2 5.4	8.5 6.7 8.4 5.0	1.5 4.8 6.7 2.3	4.4 5.5 6.5 3.8	125 106 96 142	16 3 15 11	Ground
SHOSHONE RIVER East Entrance Sylvan Pass	10E6 10E5	7000 7100									Ground Surface
TONGUE RIVER Burgess Junction Big Goose Dome Lake	7E4 7E2 7E5	7900 7700 9000									Not Frozen
POWDER RIVER North Powder Muddy Pass Sour Dough Soldier Park	7E8 7E7 6F1 7E6	8500 9700 8500 8700	May 2 May 1	33.5 24.9	7.4 4.9	9.5 6.0	0.0	5.2	94	2 15	ñ



MISSOURI BASIN			Date	Snow		Water	Content				
DRAINAGE BASIN AND	No.	Elev.	of Survey	Depth (In.)	May 1		lecords	Avera	7 1	Years of	Ground Surface
SNOW COURSE **			1951	1951	1951	1950	1949	Avg.	%Avg.	Record	Condition
			COLUMBIA	RIVER 1	DRAINAGE	IN MONT	ANA				
KOOTENAI Baree Mountain	2 502	6000	W 0	0(1	101	(0.3					
Blue Bird Basin	15B1 14A1	6800	May 2 May 1	96.4 112.5	40.4	68.1 53.7	51.1	40.0	101	15	
Brush Creek	14A4	5000	May 1	34.6	8.6	17.1	30.1	5.9	125	13	en
Fernie	Canada	3500	Apr. 30	5.3	2.1	7.7	0	2.9	72	5	Frozen
New Fernie	Canada	4100	Apr. 30	26.0	11.1					í	
Ferguson	Canada	3000	Apr. 30	25.8	13.6	18.9	11.7	15.8	86	5	Not
Gray Creek	Canada	5100	Apr. 28	53.5	19.7	24.5	18.4	21.0	94	4	
Marble Canyon	Canada	5000 6000	Apr. 29	44.0	19.1	16.7	10.2	13.0	147	- 4	in
Red Mountain Mont. Sandon	15A1 Canada	3500	May 2 May 1	58.9 No Sno	19.9	31.1	16.3	15.2	130	14	Ground
Sinclair Pass	Canada	4500	Apr. 29	6.2	3.1	3.2	0.2	3.1	-	5	G
Smith Creek	16A1	4800	Apr. 30	81.0	38.7	55.8	40.2	34.8	110	13	
Sullivan Mine	Canada	5100	May 1	35.6	12.9	16.6	7.9	11.5	112	1	
Upper Elk River	Canada	4400	-								

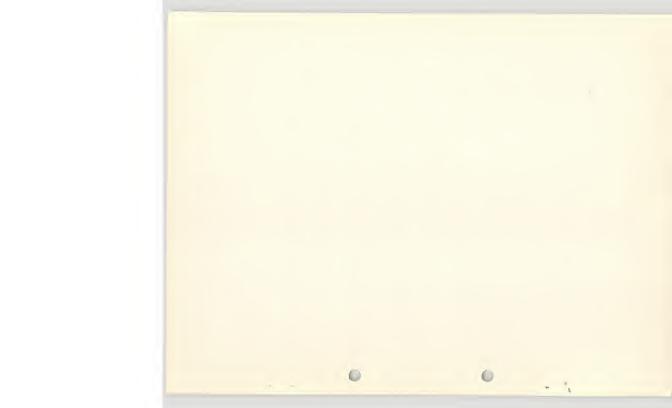


			Date	Snow		Water	Content	(Inches			
DRAINAGE BASIN	No.	Elev.	of Survey	Depth (In.)	May 1	Past R	nanada	Avera	ge Data	Years	Ground Surface
SNOW COURSE **	1400	TTEA.	1951	1951	1951	1950	1949	Avg.	%Avg.	Record	Condition
FLATHEAD RIVER											
Big Creek	13B3	6750	May 3	118.1	48.0	60.0	22.2	45.4	106	3	
Brush Creek	14A4	5000	May 1	34.6	8.6	17.1		5.9	146	8	
Cattle Queen	13A1	4700	Apr. 27	74.6	31.7	11.6	21.5	16.7	190	7	
Desert Mountain	13A2	5600	Apr. 30	36.0	14.8	21.7	10.8	9.9	150	15	
Hell Roaring Divide	14A3	5700	Apr. 30	54.8	24.0	37.4	26.7	27.1	90	10	
Limestone Pass	13B8	7600	May 3	114.0	40.3	29.0				2	
Logan Creek	14A5	4300	Apr. 30	3.4	1.0	7.1	3.4	1.8		13	Frozen
Marias Pass	13A5	5250	Apr. 27	45.6	19.7	26.3	12.1	9.2	214	17	20
North Fork Jocko	13B7	6330	May 5	91.2	43.4	59.6	0010	35.8	121	4	Si Gi
Rainy Lake	13B6	4300	Apr. 30	No Sno	wc	10.2	T			5	
Snow Lab. #16	13A9	5200	Apr. 24	57.0	22.0	28.0	17.0	20.4	108	552	Not
Spotted Bear Mt.	13B2	7000	Apr. 29	15.3	6.8	18.1	-				
Strawberry Lake	13B10	6500	Apr. 30	73.0	47.9	58.8	35.4	47.3	101	3	ra un
Trinkus Lake	13B1	6500	Apr. 30	81.6	32.9	53.1	36.5	41.2	80	3	Ground
Trout Lake #2	13A12	3600	Apr. 30	16.7	5.5					1	3
Upper Holland Lake	13B5	7000	Apr. 27	72.0	33.5					1	
Basin Creek	13B14	5000	May 3	11.3	3.1		-			1	
Holbrook	13B13	4530	May 3	6.4	1.4					1	
Quintonkon	13A13	3800	Apr. 30	10.9	4.6					1	
Twin Creeks	13B11	3580	Apr. 28	No Sno	WC					_	
UPPER CLARK FORK											
Chessman Res.	1205	6200	May 2	14.9	3.0	7.8	0.0	1.6	187	16	
North Fork Jocko	13B7	6330	May 5	91.2	43.4	59.6		35.8	121	4	
Pipestone Pass	12D1	7200	May 2	29.0	6.3	3.2	1.0	1.8	350	12	
Rainy Lake	13B6	4200	Apr. 30	No Sno		10.2	T	1.0		5	
Stemple Pass	1301	6900	May 3	hh.h	11.2	14.2	6.3	5.6	200	17	
Tenmile, Lower	1202	6250	May 3	20.5	5.1	8.9	0.2	2.2	232	16	
El Dorado Mine	1309	7800	May 5	71.0	27.2	37.2				2	
Game Pass		8100	May 5	76.0	29.0					1	
Gold Creek Lake	13C8	7200	May 5	48.5	19.6	29.0	16.5	21.7	90	3	



			Date	Snow		Water C	ontent	(Inches)			
DRAINAGE BASIN AND	No.	Elev.	of Survey	Depth (In.)	May 1		lecords	May		Years	Ground Surface
SNOW COURSE **			1951	1951	1951	1950	1949	Avg.	%Avg.	Record	Condition
UPPER CLARK FORK (C	Continued)										
Tenmile, Upper	12C3 15B2	6800 5250	May 4 May 1	46.0 67.0	14.8 27.5	18.8	7.1	10.2	145	16 13	пе
PEND OREILLE	2,552)_)	mod I	0100	-107	4761	70.0)),,0	00	1.7	Frozen
Baree Mt.	1381	6000	May 2	96.4	40.4	68.1	51.1	40.0	101	15	Not F
*Mosquito Ridge	16A4	5600	May 2	65.0	26.8	47	34.1	28.1	95	13	1
BITTERROOT	7.200	77.00	M 2	60.5	02 (00.0	00.0				Ground
Gibbons Pass	13D2	7100	May 1	60.5	23.6	28.3	22.9	19.4	122	16	Gre

^{*} Adjacent Basin





Federal - State - Private

COOPERATIVE SNOW SURVEYS

Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation, navigation, mining and industry

"WATER IS THE WEST'S GREATEST RESOURCE"